(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organizati n
International Bureau

(43) International Publicati n Date
14 December 2000 (14.12.2000)

PCT

(10) International Publication Number
WO 00/75594 A1

(51) International Patent Classification[7]: F41B 11/02, 11/32

(21) International Application Number: PCT/US00/15877

(22) International Filing Date: 9 June 2000 (09.06.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/138,323 9 June 1999 (09.06.1999) US
09/528,482 17 March 2000 (17.03.2000) US

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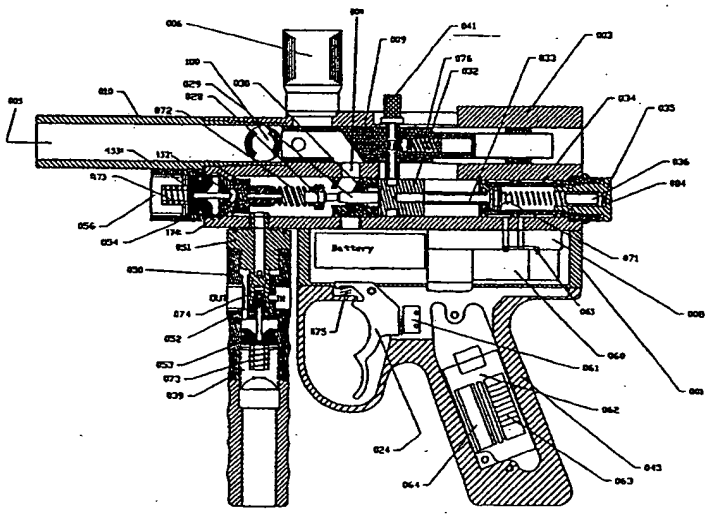
(81) Designated States *(national)*: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *With international search report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: SPRING-ASSISTED COMPRESSED GAS GUN



(57) Abstract: A compressed gas powered gun having a compressed gas and spring biased slider (33) reciprocally moveable within a pneumatic gas cylinder (34) within the gun; the slider being released by the actuation of the solenoid (60) via electronic signals from a microprocessor triggered by the depression of the gun's trigger (24) by a user. The slider includes a hammer (32) for engaging a horizontally oriented valve stem to release compressed gas from a gas source into the barrel and breech of the gun for propelling a projectile. Recocking of the slider is done by deactuation of the solenoid. A gas control system includes specific faceted angles within the breech to control pressure within the barrel and breech, hence controlling projectile velocity. The valve stem is parallel to the slider.

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SPRING-ASSISTED COMPRESSED GAS GUN

DESCRIPTION

BACKGROUND OF THE INVENTION

Field of the Invention.

This invention generally relates to compressed gas-powered guns and more specifically to guns for firing marker projectiles such as "paint balls." The use of marking guns is well-known. Within a marking gun, there is employed a projectile which is generally in the shape of a marble. This projectile is constructed of a thin wall which is to readily break upon being propelled against a target. Typical construction for the wall of the projectile would be a gelatin. Within the wall of the projectile is contained a quantity of a liquid such as a colored paint. A typical color would be red.

Related Art.

Compressed gas powered guns for the firing of projectiles have long been used. Of more recent use, such guns have been made for the firing of spherical and fragile projectiles containing a colored marking fluid, such projectiles commonly being referred to as "paint balls." Such guns are typified by other inventions of the Inventor, namely U.S. Patent No. 5,497,758, showing a compressed gas powered gun. Problems associated with such guns include: dangerously high pressure build-up within the gun potentially damaging the gun and endangering the user; a mechanical limitation on the cycle time of the firing mechanism limiting the firing rate of the gun; excessive shock and recoil resulting from reciprocal movement of the hammer into the firing and recocked positions.

SUMMARY OF THE INVENTION

The present invention is a compressed gas powered gun for the firing of projectiles. The invented gun has many improvements over the prior art including: the use of improved gas pressure routing allowing for operation at lower pressures with no decrease in firing rate, efficiency, trajectory, or range; the addition of a pressure regulating system which prevents the pressure from building to dangerous levels; the use of a hammer dampener system, and the use of a spring

assisted pneumatic firing system which decreases the mechanical limitation on the cycle time of the firing mechanism thereby increasing firing rate. The structure of the present invention provides for embodiments which include: the use of specific faceted angles within a portion of the breech through which the gas is routed as it expands; the use of high pressure and low pressure check valves within the high pressure and low pressure regulators, respectively, which shut down the flow of gas if gas pressure climbs above a pre-determined level; the use a spring and pressurized gas to dampen the forward motion of the hammer, and an o-ring to dampen the rearward motion of the hammer; and the use of a spring biased slider to more efficiently bias the slider, and thus the hammer, into the firing position.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a side, schematic view of one embodiment of the present invention showing the invented gun in the cocked position.

Figure 2 is a side, schematic view of another embodiment of the present invention showing the invented gun in the firing position.

Figure 3 is a side, schematic view of pneumatic gas cylinder assembly.

Figure 4 is a side schematic view of a section of the pressure routing system.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, an embodiment to be preferred of a compressed gas powered gun, made according to the present invention, is disclosed. Gun includes, generally, a grip **45**; a body, including an upper main housing **3** and a lower main housing **1**; a barrel **10**; a bore **5**; a bolt **9** within a breech; a hammer chamber **2**; a pneumatic gas cylinder **34**; a slider **33**; and a trigger **24**. Throughout the Description, the term "forward" indicates being towards the outer, open, free end of the barrel **10** extending from the upper main housing **3** of the gun. "Rearward" indicates the opposite direction of "forward".

As shown in **Figures 1 and 2**, a projectile feed tube **6** opens into the barrel **10**, said projectile feed tube **6** for supplying the barrel **10** with projectiles **100**, which are preferably spherical in form and contain a marking fluid. A conventional projectile retention lever (not shown) biased by a spring allows only one projectile **100** to enter the barrel **10** at a time.

Generally rearward and below the barrel **10**, the hammer chamber **2** holds a hammer **32** which is integrally attached to the forward end of the slider **33**. Slider **33** is horizontally and reciprocally moveable within gas cylinder **34** from a cocked position, as shown in **Figure 1**, to a firing position, as shown in **Figure 2**, through the use of spring bias and compressed gas. The slider **33** is cocked by means of an electronic solenoid actuated 4-way valve **65** located in the lower main housing **1**. A manifold **8** connects the 4-way valve **65** to the pneumatic gas cylinder **34**. When biased to the firing position, the slider **33** forces the hammer **32** to engage a valve stem **29**. A link pin **41**, circular in cross-section, extends between and connects the bolt **9** to the hammer **32**.

The bolt **9** is held within the gun through use of the link pin **41**, attached to the hammer **32**. Removal of the link pin **41** allows the bolt **9** to be removed from the gun. This may be done for routine maintenance. The link pin **41** is held in place by means of a bolt retention spring **76**.

Within the pneumatic gas cylinder **34**, a main compression spring **71** extends between the slider **33** and an end-cap **35** which is attached at the rearward end of the gas cylinder **34**. A main spring guide **36** rests within the cylinder **34** between the slider **33** and the end-cap **35**, said guide **36** for receiving the compressed main compression spring **71**. Slider **33** is biased forward to a firing position by the main compression spring **71** and compressed gas (not shown). The shock of the hammer **32** is dampened both as the hammer **32** moves forward into the firing position and as it returns to a recocked position. The forward motion of the hammer **32** is dampened by both the valve spring **72** and the compressed gas surrounding the valve spring **72**. The rearward motion of the hammer **32** is dampened by an o-ring **84** located in gas cylinder **34**, between the guide **36** and the end-cap **35**.

Releasably holding the slider **33** in a cocked position is an electronic solenoid activated 4-way valve **65**. The electronic solenoid **60** is actuated through a micro-switch **61** located rearward of the trigger **24**. Pulling on the trigger **24** sends an electronic signal to a CPU (microprocessor) **64** located in the grip **45**. This CPU **64** by means of software determines which of a number of dual in-line package (hereinafter 'dip') switches **63** have been switched on or off, thereby determining the firing rate and mode selected by the user. The CPU **64** then, based on firing rate and mode, actuates the solenoid **60**, causing the 4-way valve **65** to shift, causing the slider **33** to be propelled forward under the bias of spring pressure and compressed gas. The CPU **64** then deactuates the solenoid **60** causing the 4-way valve **65** to shift, and compressed gas forces the main compression

spring **71** to compress thereby recocking the gun. A trigger spring **75** forces the trigger **24** back to its original position.

Compressed gas for propelling projectile **100** and for moving the slider **33** to a firing position is provided from a canister or cylinder (not shown), which may be attached directly to gun or may be attached to the person operating the gun. The gas is fed through a high pressure (hereinafter "HP") regulator **50**, and then through a passageway through a high pressure adaptor **51** to a cavity defined by lower main housing of body **1**. The high pressure regulator **50** reduces the gas pressure from over 500 pounds per square inch (hereinafter "p.p.s.i.") to around (hereinafter "~") 250 p.p.s.i. The HP regulator comprises a HP adjustment screw **39**, a HP regulator spring **73**, a HP regulator piston **53**, a HP regulator cup **52**, and a HP regulator cup spring **74**. This high pressure regulator **50** further comprises a safety feature forcibly closing the high pressure regulator cup **52** when over 800 or so p.p.s.i. is applied. This closure protects the inner workings of the gun and protects the gun's operator.

Contained within the cavity are two valve means. The first valve means is for propelling the slider **33**. The second valve means is for supplying gas to propel the projectile **100**. The first valve means further comprises a low pressure (hereinafter "LP") regulator **54** for reducing pneumatic gas pressure from the ~250 p.p.s.i. supplied to ~85 p.p.s.i. This pressurized gas is then channeled to the gas cylinder **34** for the propulsion of the slider **33** upon actuation of the trigger **24**. The LP regulator comprises a LP adjustment screw **56**, a LP regulator spring **173**, a LP regulator piston **153**, a LP regulator cup **152**, and a LP regulator cup spring **174**. This low pressure regulator **54** further comprises a safety feature forcibly closing the low pressure regulator cup **152** when over 300 or so p.p.s.i. is applied. This closure protects the inner workings of the gun and protects the gun's operator.

The second valve means includes a horizontally oriented valve stem **29** which is horizontally and reciprocally moveable within a valve stem guide **30**. Valve stem **29** is provided with a valve cup **28** which engages a valve spring **72**, biasing the valve cup **28** to a seated position on the valve stem guide **30** to prevent flow of compressed gas from cavity into the barrel **10**.

It has also been found that projectile **100** velocity can be controlled through the use of specifically angled surfaces within the gas passage **4**, through which the gas expands as it enters the barrel **10**. The gas passage **4** is defined by the continuous conduit extending from the valve cup **28**,

through the valve stem guide **30** and the forward portion of the bolt **9**. When the valve cup **28** is biased to an open/firing position, the gas is allowed to expand through the conduit extending through the valve stem guide **30** and the bolt **9**. The inner surfaces of the valve stem guide **30** and the bolt **9** are machined to a form a conduit having a specific angle through which the gas expands. It has been found by the inventor that 23 degrees ± 5 degrees is the optimal angle for these surfaces. Use of such angular surfaces allows the present invention to fire a projectile **100** using less than one half the p.p.s.i. of traditional guns at the same firing rate as those guns, without jeopardizing the efficiency, trajectory or range of the projectile **100**. By funneling the gas as it expands through the use of such angular surfaces, resistance is reduced, thereby allowing firing at a high firing rate to be done with lower p.s.i.

The gun further comprises an electronic system comprising a circuit board **62** containing a microprocessor (CPU) **64**, and a series of dip switches **63** which can be set to control the firing rate and mode of the gun. The gun is further programable so as to allow firing rate and mode limits to be forcibly set.

Sequential action of the gun may be seen to advantage. A projectile **100** is in place within the barrel **10**. A second projectile (not shown) is held in place above the barrel **10** and within feed tube **6** by the projectile retention lever (not shown). Slider **33** is in the cocked position via the solenoid **60**. It is assumed that the high pressure regulator **50** is in fluid communication with an external compressed gas source (not shown) to fill cavity with compressed gas.

The trigger **24** is then pulled, a microswitch **61** is activated sending a signal to the CPU **64** that the user wishes to fire the gun. The CPU **64** then determines which dip switches **63** have been preset by the user, thereby determining the firing rate and mode of the gun. Upon determining the firing rate and mode, the CPU **64** then directs the solenoid **60** to act accordingly. The firing rate and mode of the gun are detailed as follows:

DIP Switch settings - Modes - Rate of Fire:

(Note: the following settings are not shown in attached **Figures**.)

Rate of fire is dependant on the mode and switch settings of the dip switches. Modes are:

1. semi-auto (one single shot per trigger pull),
2. 3 shot (3 shots if the trigger is pulled and not released, with single shot capabilities),

3. 6 shot burst (6 shots if the trigger is pulled and not released, with single shot or any amount between capabilities),

4. Full auto (as long as the trigger is pulled it will cycle).

Mode selection is done via switches #1 and #2. Mode settings using the switches are as follows:

#1	#2	
off	off	Semi mode
on	off	3 shot mode
off	on	6 shot burst mode
on	on	Full auto mode

Rate of Fire and timing is as follows:

Dip switch #3 and #4 (registers Solenoid on; times in milliseconds)

#3	#4	
off	off	= 06 ms
on	off	= 08 ms
off	on	= 10 ms
on	on	= 12 ms

Dip switch #5, #6, and #7 (registers Solenoid off (delay before re-cycle); times in milliseconds)

#5	#6	#7	
off	off	off	= 70 ms
on	off	off	= 80 ms
off	on	off	= 90 ms
on	on	off	= 100 ms
off	off	on	= 110 ms
on	off	on	= 120 ms
off	on	on	= 130 ms
on	on	on	= 140 ms

Dip switch 8: display cycle rate, mode and shot count.

on = display yes

off = display no.

As the solenoid **60** is deactuated, the gun is cocked. As the solenoid **60** is actuated, compressed gas and the main compression spring **71** move the hammer **32** and slider **33** to the firing position, by moving the slider **33** forward with hammer **32** slidably engaging the valve stem **29**. The hammer **32** engages valve stem **29**, thereby unseating the valve cup **28**, causing the release of compressed gas into the gas passage **4**, thereby propelling the projectile **100** through the barrel **10**.

The slider **33** has moved forward into the firing position forcing the hammer **32** to engage tip of valve stem **29**. Simultaneously, valve stem **29** is forced inwardly against the bias of valve spring **72** to unseat the valve cup **28** from its seat, thus allowing the compressed gas to enter the barrel **10**. Gas entering the barrel **10** progresses through conduit formed by angular surfaces of the valve stem guide **30** and the forward portion of the bolt **9**, forcing projectile **100**, which has a diameter approximating that of the bore **5** of the barrel **10**, out of the barrel **10** at a velocity dependent upon the gas pressure within the barrel **10** which is controlled by high pressure regulator **50**. The solenoid **60** is then deactuated to force the slider **33** and hence hammer **32** back to the recocked position. Valve stem **29** is again biased into its seated position by valve spring **72** to prevent further flow of compressed gas into the barrel **10**. Upon deactuation of solenoid **60**, the slider **33** and hence the link pin **41** and bolt **9** are forced back to the recocked position. As the bolt **9** moves to the recocked position, the projectile retention lever (not shown) allows a new projectile **100** to enter barrel **10** and again holds a next projectile (not shown) in place under bias of spring.

Having thus described in detail a preferred embodiment of the present invention, it is to be appreciated and will be apparent to those skilled in the art that many physical changes could be made in the apparatus without altering the inventive concepts and principles embodied therein. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore to be embraced therein.

What is claimed is:

Claims:

1. A compressed gas gun comprising:

a barrel, said barrel having a bore;

a breech;

a reciprocating piston;

a trigger assembly;

a grip;

a pressurized gas supply;

a gas chamber;

a projectile feed tube;

a projectile propelling mechanism, operation of said trigger assembly causes activation of said projectile propelling mechanism resulting in discharging of a projectile from said bore of said barrel,

the improvements in the present invention comprising:

a pneumatic gas cylinder assembly further comprising: _

a cylinder in which said piston reciprocates horizontally, said cylinder having a front end and a rear end; a spring guide located within said cylinder; a spring connecting said piston and said guide; a valve means for connecting said cylinder to said gas supply; said cylinder, piston, guide and spring being axially aligned;

a gas passage arrangement further comprising:

angled surfaces forming a conduit connecting said gas chamber with said bore, said angled surfaces forming an angle of about 23 degrees ± 5 degrees from a horizontal axis of said gas chamber and an angle of about 23 degrees ± 5 degrees from a horizontal axis of said bore;

a high pressure regulating mechanism further comprising:

a high pressure regulator check valve which forcibly closes when said high pressure regulating mechanism is exposed to pressures above about 800 pounds per square inch;

a low pressure regulating mechanism further comprising:

a low pressure regulator check valve which forcibly closes when said low pressure regulating mechanism is exposed to pressures above about 300 pounds per square inch;

an end-cap attached to said rear end of said cylinder, further comprising:

an o-ring located between said end-cap and said guide, said o-ring for dampening a recoil effect from said reciprocating piston.

2. A compressed gas gun comprising:

a barrel, said barrel having a bore;

a breech;

a reciprocating piston;

a trigger assembly;

a grip;

a pressurized gas supply;

a gas chamber;

a projectile feed tube;

a projectile propelling mechanism, operation of said trigger assembly causes activation of said projectile propelling mechanism resulting in discharging of a projectile from said bore of said barrel,

the improvements in the present invention comprising:

a pneumatic gas cylinder assembly further comprising:

a cylinder in which said piston reciprocates horizontally, said cylinder having a front end and a rear end; a spring guide located within said cylinder; a spring connecting said piston and said guide; a valve means for connecting said cylinder to said gas supply; said cylinder, piston, guide and spring being axially aligned.

3. A compressed gas gun as in Claim 2, wherein:

said improvements further comprise:

a gas passage arrangement further comprising:

angled surfaces forming a conduit connecting said gas chamber with said bore, said angled surfaces forming an angle of about 23 degrees ± 5 degrees from a horizontal axis of said gas chamber and an angle of about 23 degrees ± 5 degrees from a horizontal axis of said bore.

4. A compressed gas gun as in Claim 2, wherein:

said improvements further comprise:

a gas passage arrangement further comprising:

angled surfaces forming a conduit connecting said gas chamber with said bore, said angled surfaces forming an angle of about 23 degrees ± 5 degrees from a horizontal axis of said gas chamber and an angle of about 23 degrees ± 5 degrees from a horizontal axis of said bore;

a high pressure regulating mechanism further comprising:

a high pressure regulator check valve which forcibly closes when said high pressure regulating mechanism is exposed to pressures above about 800 pounds per square inch.

5. A compressed gas gun as in Claim 2, wherein:

said improvements further comprise:

a gas passage arrangement further comprising:

angled surfaces forming a conduit connecting said gas chamber with said bore, said angled surfaces forming an angle of about 23 degrees ± 5 degrees from a horizontal axis of said gas chamber and an angle of about 23 degrees ± 5 degrees from a horizontal axis of said bore;

a high pressure regulating mechanism further comprising:

a high pressure regulator check valve which forcibly closes when said high pressure regulating mechanism is exposed to pressures above about 800 pounds per square inch;

a low pressure regulating mechanism further comprising:

a low pressure regulator check valve which forcibly closes when said low pressure regulating mechanism is exposed to pressures above about 300 pounds per square inch.

6. A compressed gas gun comprising:

a barrel, said barrel having a bore;

a breech;

a reciprocating piston;

a trigger assembly;

a grip;

a pressurized gas supply;

a gas chamber;

a projectile feed tube mounted on said barrel, said projectile feed tube for supplying the barrel with a projectile to be discharged from the bore of the barrel;

a projectile propelling mechanism, operation of said trigger assembly causes activation of said projectile propelling mechanism resulting in discharging of said projectile from said bore of said barrel;

the improvements in the present invention comprising:

a pneumatic gas cylinder assembly further comprising:

a cylinder in which said piston reciprocates horizontally, said cylinder having a front end and a rear end, said rear end of said cylinder having an end-cap; a spring guide located within said cylinder; a spring connecting said piston and said guide; a valve means for connecting said cylinder to said gas supply; said cylinder, piston, guide and spring being axially aligned;

a gas passage arrangement further comprising:

angled surfaces forming a conduit connecting said gas chamber with said bore, said angled surfaces forming an angle of about 23 degrees ± 5 degrees from a horizontal axis of said gas chamber and an angle of about 23 degrees ± 5 degrees from a horizontal axis of said bore;

a high pressure regulating mechanism further comprising:

a high pressure regulator spring, a high pressure regulator piston, a high pressure regulator cup, and a high pressure regulator check valve which forcibly closes said a high pressure regulator cup when said high pressure regulating mechanism is exposed to pressures above about 800 pounds per square inch;

a low pressure regulating mechanism further comprising:

a low pressure regulator spring, a low pressure regulator piston, a low pressure regulator cup, and a low pressure regulator check valve which forcibly closes said a low pressure regulator cup when said low pressure regulating mechanism is exposed to pressures above about 300 pounds per square inch;

said cylinder assembly further comprising:

an o-ring located between said guide and said end cap, said o-ring for dampening a recoil effect from said reciprocating piston.

7. A compressed gas gun comprising:

a barrel, said barrel having a bore;

a breech;

a reciprocating piston;

a trigger assembly;

a grip;

a pressurized gas supply;

a gas chamber;

a projectile feed tube mounted on said barrel, said projectile feed tube for supplying the barrel with a projectile to be discharged from the bore of the barrel;

a projectile propelling mechanism, operation of said trigger assembly causes activation of said projectile propelling mechanism resulting in discharging of said projectile from said bore of said barrel;

the improvements in the present invention comprising:

a pneumatic gas cylinder assembly further comprising:

a cylinder in which said piston reciprocates horizontally, said cylinder having a front end and a rear end, said rear end of said cylinder having an end-cap; a spring guide located within said cylinder; a spring connecting said piston and said guide; a valve means for connecting said cylinder to said gas supply; said cylinder, piston, guide and spring being axially aligned.

8. A compressed gas gun as in Claim 7, wherein:

said improvements further comprise:

a gas passage arrangement further comprising:

angled surfaces forming a conduit connecting said gas chamber with said bore, said angled surfaces forming an angle of about 23 degrees ± 5 degrees from a horizontal axis of said gas chamber and an angle of about 23 degrees ± 5 degrees from a horizontal axis of said bore.

9. A compressed gas gun as in Claim 7, wherein:

said improvements further comprise:

a gas passage arrangement further comprising:

angled surfaces forming a conduit connecting said gas chamber with said bore, said angled surfaces forming an angle of about 23 degrees ± 5 degrees

from a horizontal axis of said gas chamber and an angle of about 23 degrees ± 5 degrees from a horizontal axis of said bore;

a high pressure regulating mechanism further comprising:

a high pressure regulator spring, a high pressure regulator piston, a high pressure regulator cup, and a high pressure regulator check valve which forcibly closes said a high pressure regulator cup when said high pressure regulating mechanism is exposed to pressures above about 800 pounds per square inch.

10. A compressed gas gun as in Claim 7, wherein:

said improvements further comprise:

a gas passage arrangement further comprising:

angled surfaces forming a conduit connecting said gas chamber with said bore, said angled surfaces forming an angle of about 23 degrees ± 5 degrees from a horizontal axis of said gas chamber and an angle of about 23 degrees ± 5 degrees from a horizontal axis of said bore;

a high pressure regulating mechanism further comprising:

a high pressure regulator spring, a high pressure regulator piston, a high pressure regulator cup, and a high pressure regulator check valve which forcibly closes said a high pressure regulator cup when said high pressure regulating mechanism is exposed to pressures above about 800 pounds per square inch;

a low pressure regulating mechanism further comprising:

a low pressure regulator spring, a low pressure regulator piston, a low pressure regulator cup, and a low pressure regulator check valve which forcibly closes said a low pressure regulator cup when said low pressure regulating mechanism is exposed to pressures above about 300 pounds per square inch.

11. A compressed gas gun comprising:

an upper main housing;

a barrel, attached to the upper main housing, said barrel having a bore;

a projectile feed tube mounted on said barrel, said projectile feed tube opening into the barrel for supplying the barrel with a projectile to be discharged from the bore of the barrel;

a bolt assembly located within the upper main housing generally rearward of the barrel, said bolt assembly consisting of a bolt, a link pin, and a bolt retention spring, said bolt having a hollow forward portion;

a lower main housing attached to said barrel and said upper main housing generally below said upper main housing;

a trigger assembly connected to said lower main housing, said trigger assembly being manually operational;

a grip connected to said lower main housing and said trigger assembly generally rearward of said trigger assembly;

an electronic solenoid located in said lower main housing generally above said grip, said solenoid for actuating a four way valve, said four way valve located in said lower main housing generally above said solenoid;

a projectile propelling mechanism connected to said lower main housing and said trigger assembly generally forward of said trigger assembly, manual operation of said trigger assembly causes activation of said projectile propelling mechanism resulting in discharging of said projectile from said bore of said barrel, said projectile propelling mechanism comprising:

an exterior pressurized gas cylinder assembly comprising a gas cylinder, pressurized gas, and a means for attaching said pressurized gas cylinder assembly to said projectile propelling mechanism;

a high pressure regulating mechanism connecting said gas cylinder to said lower main housing;

a valve mechanism mounted within said lower housing connecting said high pressure regulating mechanism with said bore, said valve mechanism having

a gas chamber, a valve stem, a valve cup, and a valve stem guide, said valve mechanism having a gas passage arrangement connecting said high pressure regulating mechanism and said bore, said gas passage arrangement consisting of a conduit through said valve stem guide and said forward portion of said bolt, said valve mechanism having a closed position preventing flow of said gas to said bore, operation of said trigger assembly causing said valve mechanism to move to an open position allowing said gas to flow through said conduit into said bore, causing said projectile located in said bore to be propelled exteriorly of said barrel after which said valve mechanism returns to said closed position;

a low pressure regulating mechanism connecting said valve mechanism to said four way valve;

a pneumatic gas cylinder assembly comprising a slider, said slider comprising a hammer and a piston, said piston having a forward end and a rearward end, said hammer being attached to said forward end of said piston, said slider being horizontally and reciprocally moveable within said lower main housing, said slider being in fluid communication with said four way valve, said slider being biased to a firing position by actuation of said solenoid, said slider in said firing position engaging said valve stem causing said valve mechanism to move to said open position,

said pneumatic gas cylinder assembly further comprising:

a cylinder in which said piston reciprocates horizontally, said cylinder having a front end and a rear end, said forward end of said piston remaining exterior to said front end of said cylinder, said rear end of said cylinder having an end-cap, a main spring guide resting between said piston and said end-cap, said main spring guide having a front end and a rear end, a main compression spring connecting said rearward end of said piston and said main spring guide;

said gas passage arrangement further comprising:

angled surfaces forming a conduit connecting said gas chamber with said bore, said angled surfaces forming an angle of about 23 degrees ± 5 degrees from a horizontal axis of said gas chamber and an angle of about 23 degrees ± 5 degrees from a horizontal axis of said bore;

said high pressure regulating mechanism further comprising:

a high pressure regulator spring, a high pressure regulator piston, a high pressure regulator cup, and a high pressure regulator check valve which forcibly closes said a high pressure regulator cup when said high pressure regulating mechanism is exposed to pressures above about 800 pounds per square inch;

said low pressure regulating mechanism further comprising:

a low pressure regulator spring, a low pressure regulator piston, a low pressure regulator cup, and a low pressure regulator check valve which forcibly closes said a low pressure regulator cup when said low pressure regulating mechanism is exposed to pressures above about 300 pounds per square inch;

said end-cap further comprising:

an o-ring located at the rear end of said main spring guide, said o-ring for dampening a recoil effect from said reciprocating slider.

12. A compressed gas gun comprising:

an upper main housing;

a barrel, attached to the upper main housing, said barrel having a bore;

a projectile feed tube mounted on said barrel, said projectile feed tube opening into the barrel for supplying the barrel with a projectile to be discharged from the bore of the barrel;

a bolt assembly located within the upper main housing generally rearward of the barrel, said bolt assembly consisting of a bolt, a link pin, and a bolt retention spring, said bolt having a hollow forward portion;

a lower main housing attached to said barrel and said upper main housing generally below said upper main housing;

a trigger assembly connected to said lower main housing, said trigger assembly being manually operational;

a grip connected to said lower main housing and said trigger assembly generally rearward of said trigger assembly;

an electronic solenoid located in said lower main housing generally above said grip, said solenoid for actuating a four way valve, said four way valve located in said lower main housing generally above said solenoid;

a projectile propelling mechanism connected to said lower main housing and said trigger assembly generally forward of said trigger assembly, manual operation of said trigger assembly causes activation of said projectile propelling mechanism resulting in discharging of said projectile from said bore of said barrel, said projectile propelling mechanism comprising:

an exterior pressurized gas cylinder assembly comprising a gas cylinder, pressurized gas, and a means for attaching said pressurized gas cylinder assembly to said projectile propelling mechanism;

a high pressure regulating mechanism connecting said gas cylinder to said lower main housing;

a valve mechanism mounted within said lower housing connecting said high pressure regulating mechanism with said bore, said valve mechanism having a gas chamber, a valve stem, a valve cup, and a valve stem guide, said valve mechanism having a gas passage arrangement connecting said high pressure regulating mechanism and said bore, said gas passage arrangement consisting of a conduit through said valve stem guide and said forward portion of said bolt, said valve mechanism having a closed position preventing flow of said gas to said bore, operation of said trigger assembly causing said valve mechanism to move to an open position allowing said gas to flow through said conduit into said bore, causing said projectile located in

said bore to be propelled exteriorly of said barrel after which said valve mechanism returns to said closed position;

a low pressure regulating mechanism connecting said valve mechanism to said four way valve;

a pneumatic gas cylinder assembly comprising a slider, said slider comprising a hammer and a piston, said piston having a forward end and a rearward end, said hammer being attached to said forward end of said piston, said slider being horizontally and reciprocally moveable within said lower main housing, said slider being in fluid communication with said four way valve, said slider being biased to a firing position by actuation of said solenoid, said slider in said firing position engaging said valve stem causing said valve mechanism to move to said open position,

said pneumatic gas cylinder assembly further comprising:

a cylinder in which said piston reciprocates horizontally, said cylinder having a front end and a rear end, said forward end of said piston remaining exterior to said front end of said cylinder, said rear end of said cylinder having an end-cap, a main spring guide resting between said piston and said end-cap, said main spring guide having a front end and a rear end, a main compression spring connecting said rearward end of said piston and said main spring guide.

13. A compressed gas gun as in Claim 12, wherein:

said gas passage arrangement further comprising:

angled surfaces forming a conduit connecting said gas chamber with said bore, said angled surfaces forming an angle of about 23 degrees ± 5 degrees from a horizontal axis of said gas chamber and an angle of about 23 degrees ± 5 degrees from a horizontal axis of said bore.

14. A compressed gas gun as in Claim 12, wherein:

said gas passage arrangement further comprising:

angled surfaces forming a conduit connecting said gas chamber with said bore, said angled surfaces forming an angle of about 23 degrees ± 5 degrees from a horizontal axis of said gas chamber and an angle of about 23 degrees ± 5 degrees from a horizontal axis of said bore;

said high pressure regulating mechanism further comprising:

a high pressure regulator spring, a high pressure regulator piston, a high pressure regulator cup, and a high pressure regulator check valve which forcibly closes said a high pressure regulator cup when said high pressure regulating mechanism is exposed to pressures above about 800 pounds per square inch.

15. A compressed gas gun as in Claim 12, wherein:

said gas passage arrangement further comprising:

angled surfaces forming a conduit connecting said gas chamber with said bore, said angled surfaces forming an angle of about 23 degrees ± 5 degrees from a horizontal axis of said gas chamber and an angle of about 23 degrees ± 5 degrees from a horizontal axis of said bore;

said high pressure regulating mechanism further comprising:

a high pressure regulator spring, a high pressure regulator piston, a high pressure regulator cup, and a high pressure regulator check valve which forcibly closes said a high pressure regulator cup when said high pressure regulating mechanism is exposed to pressures above about 800 pounds per square inch;

said low pressure regulating mechanism further comprising:

a low pressure regulator spring, a low pressure regulator piston, a low pressure regulator cup, and a low pressure regulator check valve which forcibly closes said a low pressure regulator cup when said low pressure

regulating mechanism is exposed to pressures above about 300 pounds per square inch.

16. A compressed gas gun as in Claim 2, wherein:
said improvements further comprise:
a high pressure regulating mechanism further comprising:
a high pressure regulator check valve which forcibly closes when said high pressure regulating mechanism is exposed to pressures above about 800 pounds per square inch;
a low pressure regulating mechanism further comprising:
a low pressure regulator check valve which forcibly closes when said low pressure regulating mechanism is exposed to pressures above about 300 pounds per square inch;
an end-cap attached to an end of a cylinder, further comprising:
a guide within said cylinder, an o-ring located between said end-cap and said guide, said o-ring for dampening a recoil effect from said reciprocating piston.

17. A compressed gas gun as in Claim 2, wherein:
said improvements further comprise:
an end-cap attached to an end of a cylinder, further comprising:
a guide within said cylinder, an o-ring located between said end-cap and said guide, said o-ring for dampening a recoil effect from said reciprocating piston.

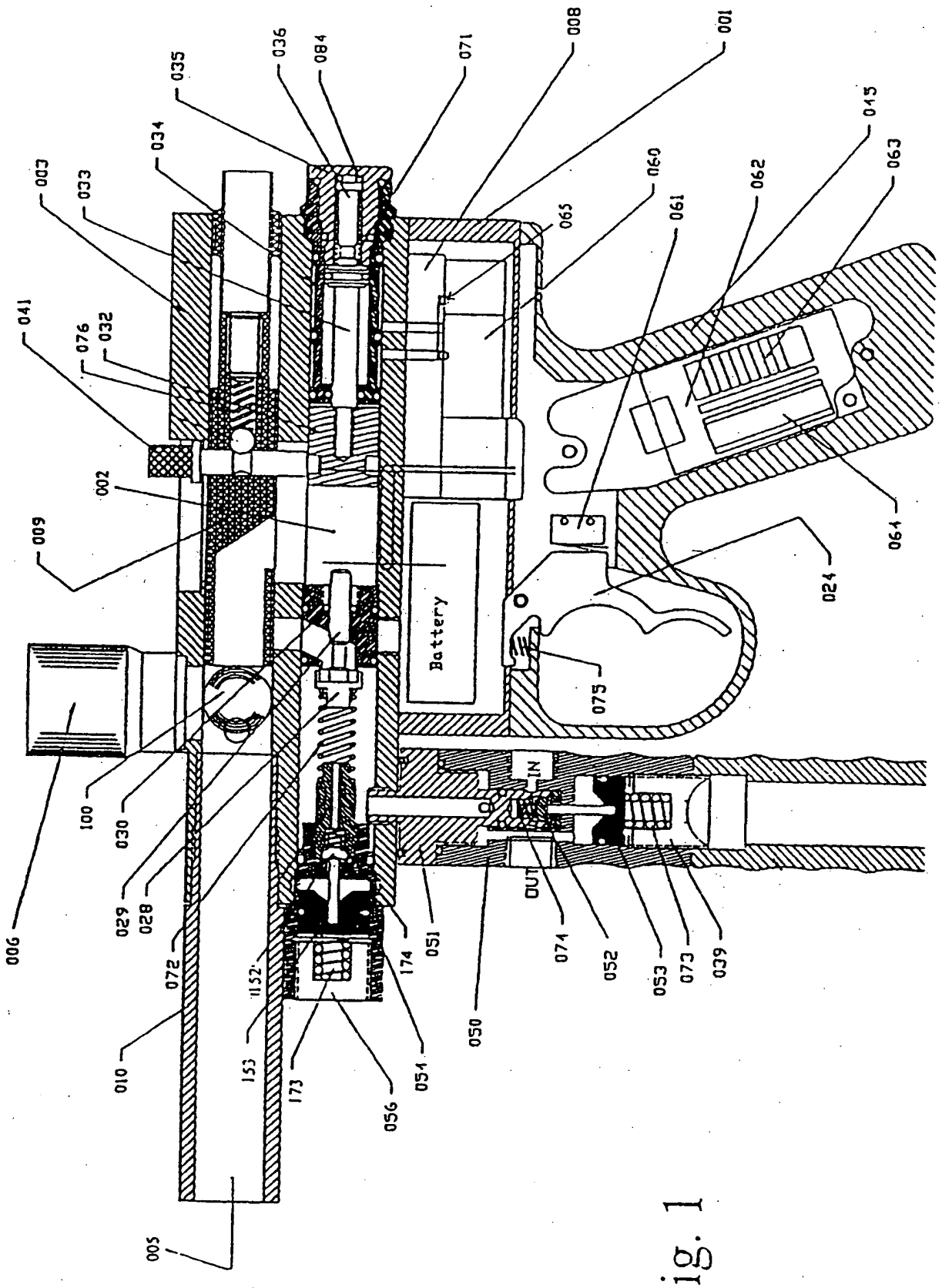
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Fig. 1

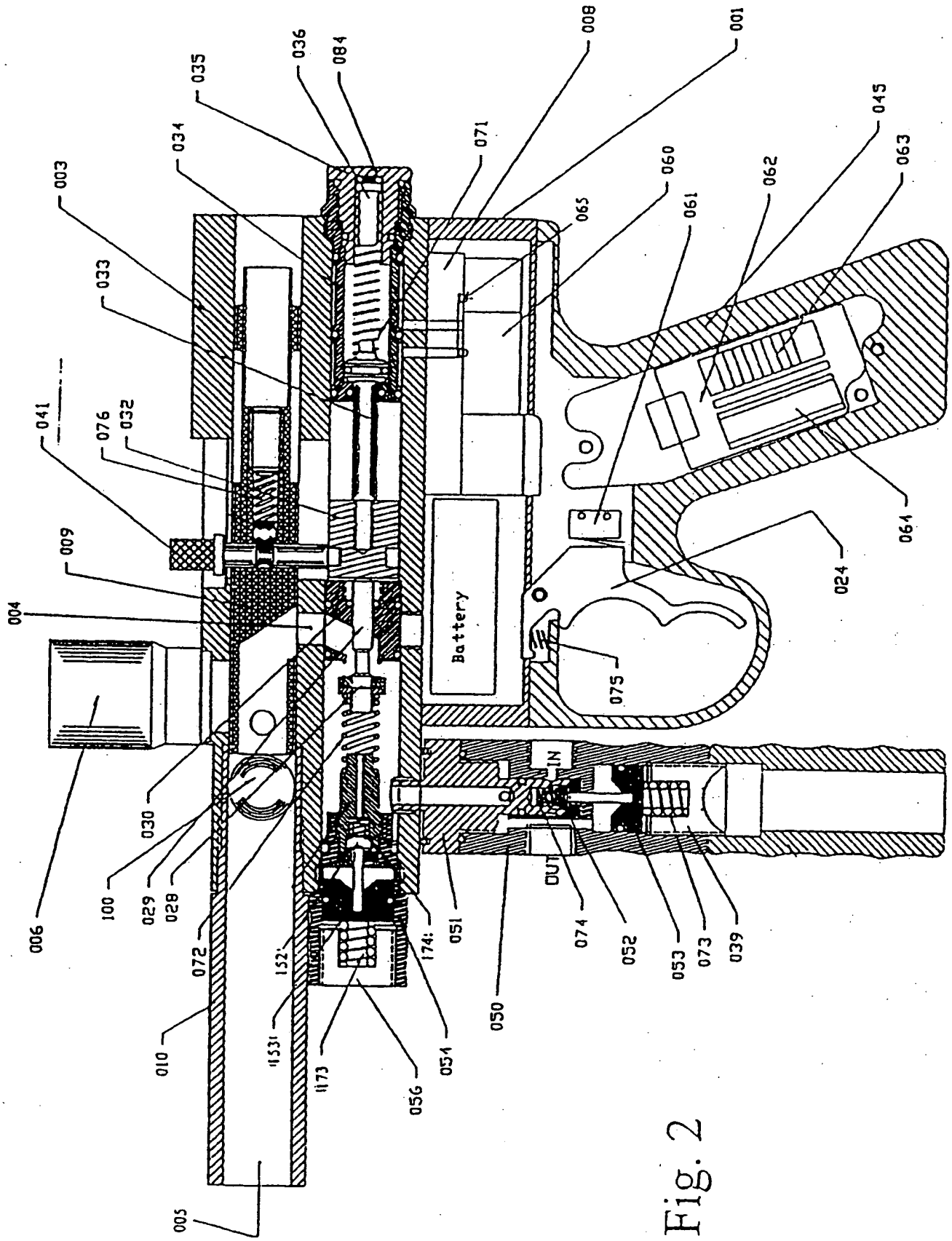
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Fig. 2

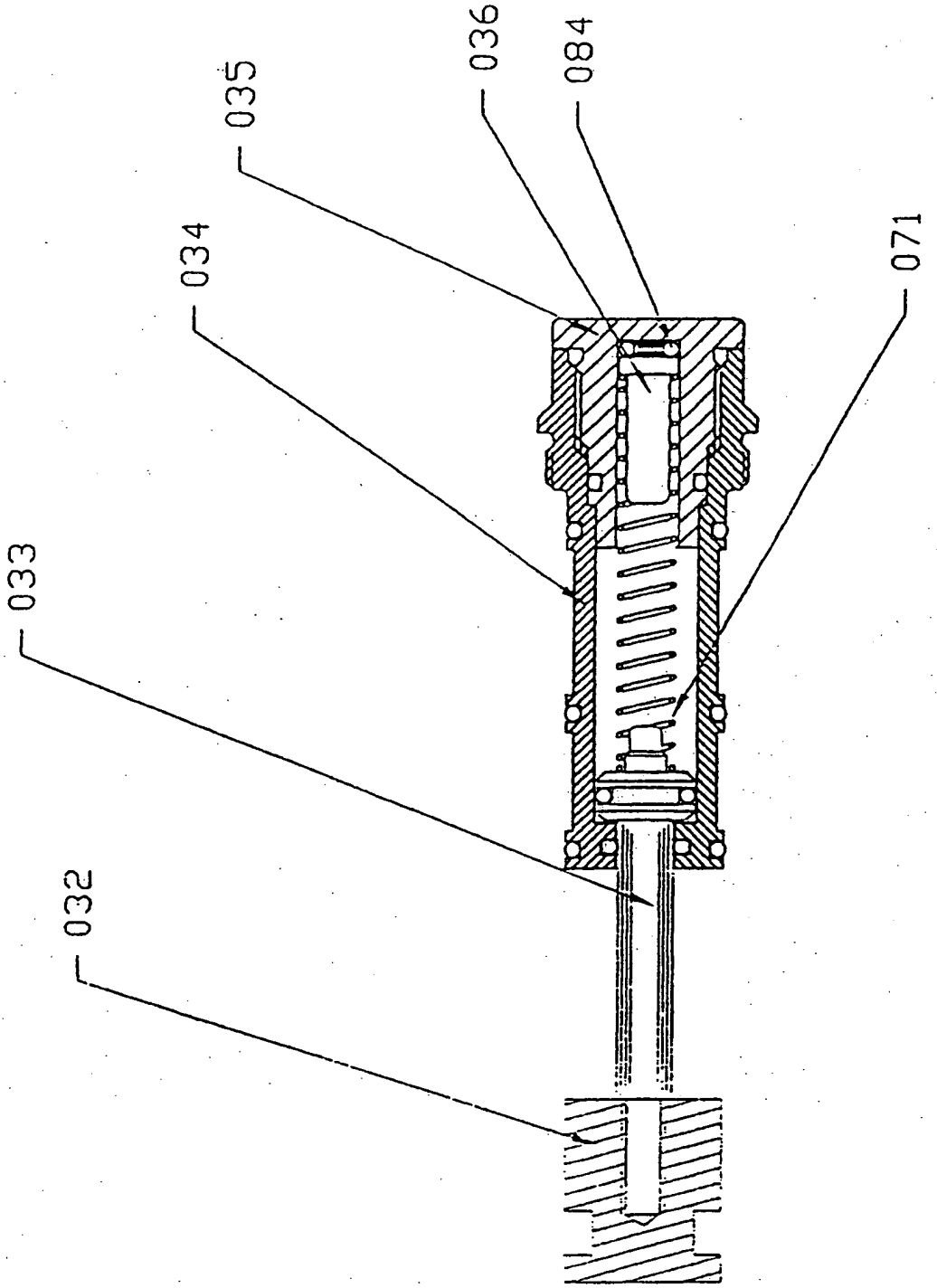

Fig. 3

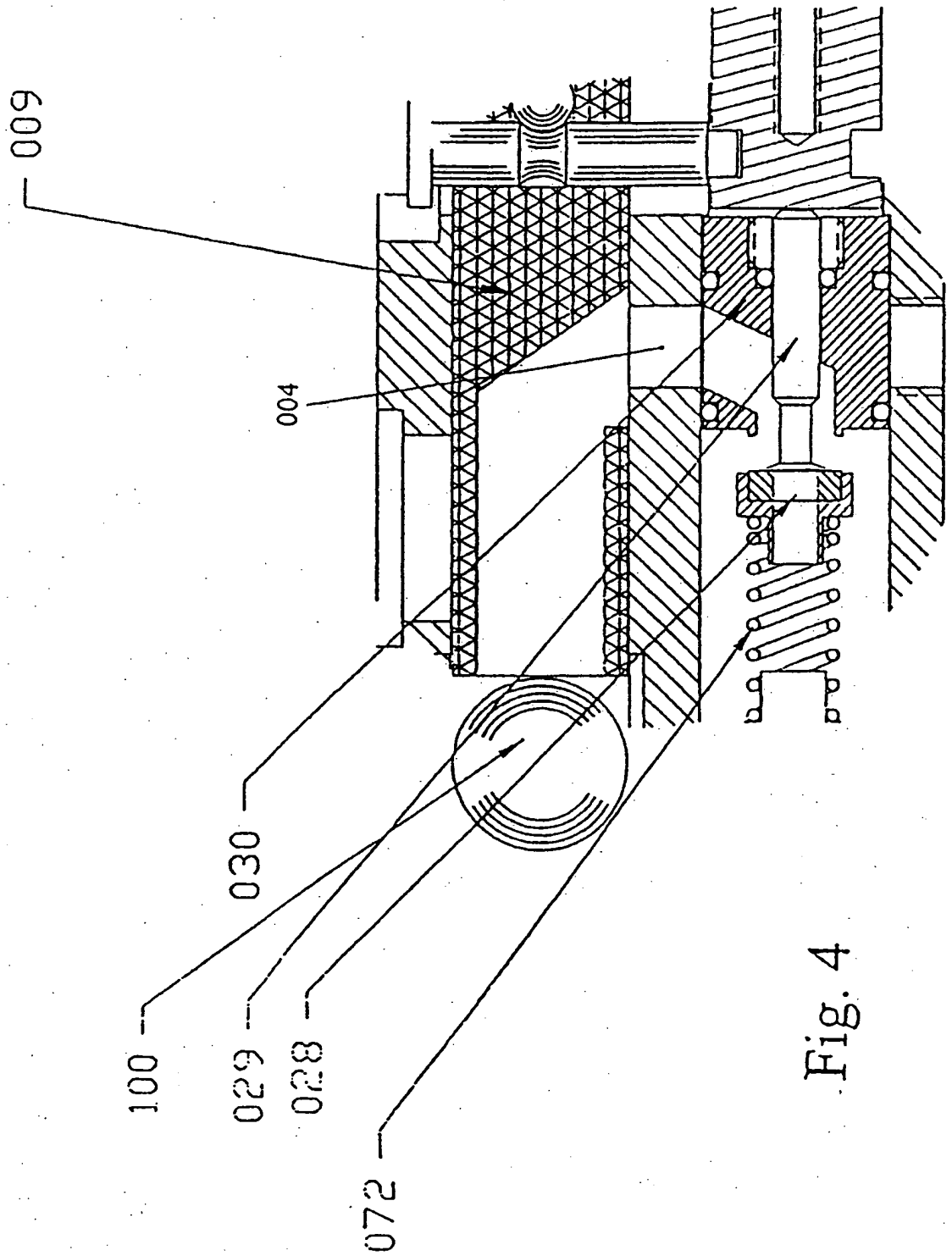

Fig. 4

INTERNATIONAL SEARCH REPORT

Inte Ional Application No
PCT/US 00/15877

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F41B11/02 F41B11/32

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F41B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 99 00635 A (LOTUACO NICANOR D III ;BRASS EAGLE INC (US)) 7 January 1999 (1999-01-07) the whole document ---	1,2,6,7, 11,12
A	US 5 063 905 A (FARRELL KENNETH R) 12 November 1991 (1991-11-12) column 7, line 61 -column 8, line 5; figures 1-10 column 9, line 45 -column 11, line 30 ---	1,2,6,7, 11,12
A	US 2 554 116 A (R. MONNER) 22 May 1951 (1951-05-22) the whole document ---	1,2,6,7, 11,12
	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 September 2000	22/09/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Van der Plas, J

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INTERNATIONAL SEARCH REPORT

Inte ional Application No
PCT/US 00/15877

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 462 042 A (GREENWELL ANDREW J) 31 October 1995 (1995-10-31) column 3, line 52 -column 4, line 26; figures 1-6 column 5, line 28-38 column 6, line 1-32	1,2,6,7, 11,12
P,A	US 6 003 504 A (MARKS NICHOLAS JOHN ET AL) 21 December 1999 (1999-12-21) the whole document	1,2,6,7, 11,12

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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PCT/US 00/15877

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